POCKET COMPUTER NEWSLETTER

© Copyright 1984 POCKET COMPUTER NEWSLETTER

Issue 34 - July/August

Photo *The Portable (HP 110) from Hewlett-Packard.*

Another *Personal Information* ™ product.

"THE PORTABLE" ANNOUNCED BY HP

Hewlett-Packard Corporation, a company that has been becoming increasingly aggressive in the personal computer market, has now announced availability of a new, nine-pound, notebook-sized computer that the company refers to as "The Portable". Model-wise, it is known as the HP-110.

The new computer features a flip-up, 16-line by 80-column liquid-crystal display. The display is bit-mapped, having 480 by 128 pixels, and can thus support graphics. The flip-up display is adjustable to any desired viewing angle. Display contrast is controlled from the keyboard. The full-sized keyboard has 75 keys. Eight of these are designated as special-function keys.

Perhaps most notable about the new portable machine is the massive amount (384K!) of software built-in on ROMs. The Portable includes the popular "1-2-3" software package from Lotus Corporation. This program provides integrated spreadsheet, graphing and database management capabilities. Other software included in the unit serves up fundamental word processing capability and communicating functions. There is also a "Personal Applications Manager" executive-type program designed to make it easy to set up and manage programmed operation of The Portable.

A similarly large amount of user RAM memory (272K) is provided in the unit. A user-selectable amount of this RAM can be designated as an "electronic-disk," with the balance serving as the user's active memory area. Since the standard operating programs are resident in ROM, virtually all of the unit's RAM is available to the user for manipulation of spreadsheets, memo files, and other kinds of data.

The Portable also contains provisions for running industry-standard MS-DOS software (Version 2.11) and can share data with HP, IBM and other compatible personal computers.

The portable computer weighs less than nine pounds, including a rechargeable battery that can supply power for 16 to 20 hours of continuous operation. The special, sealed, lead-acid battery (which is not replaceable by the user) is said to have a service life in excess of five years. A unique indicator on the unit's display informs the user of the amount of charge remaining in the battery at any time. When remaining energy falls below 20%, special precautions are taken to notify the user that recharging is required. If battery energy falls to a very low level (less than 5%) the display cannot be activated. All available energy is then used to conserve the contents of the unit's CMOS memory. A fully charged battery can maintain the system's memory intact for over a year if the computer is kept turned off.

When the flip-up display is closed down over the keyboard, The Portable measures a scant 13 by 10 by 3 inches. A padded carrying case with shoulder strap and handle is provided for ease and comfort when taking the unit on a journey.

A built-in 300-baud rate, direct-connect modem enables the unit to serve as a terminal in a large computer system. The standard communications software supplied in ROM permits files to be downloaded from a remote site and vice versa.

The Portable is extremely fast in operation thanks to the use of a CMOS 8086 CPU. This is a true 16-bit microprocessor and HP has it running at a 5.33 Megahertz clock rate in The Portable. Speed of operation is also enhanced by the fact that the operating software is built into ROM. There is no waiting for disk loads, memory swapping, etc. Switching between applications, such as running Lotus 1-2-3 and then going to the word processing package, takes just a matter of seconds.

The new traveling computer will be supported by several fully-portable peripheral devices. One is HP's new ThinkJet Personal Printer, a lightweight, battery-operated printer that can be connected to The Portable. The other is the HP-9114A battery-powered 3-1/2 disk drive with 710 kilobytes-per-disk capacity. The Portable, coupled to these two peripherals, can form a complete desktop system or be used anywhere in the field, operating entirely on built-in batteries!

Other features of The Portable include a real-time clock and calendar system. This system can keep date/time events anywhere between January 1, 1980 and December 31, 2039. Built-in alarm and appointment-keeping functions can be coupled with the clock/calendar to track appointments as well as organize and find files by name, time and date. It is even possible to have The Portable turn itself on and execute a program at a specific time and date.

Hewlett-Packard reports a number ofsoftware packages, including languages such as PASCAL and BASIC, will be available on 3-1/2 inch disks fo use with The Portable.

The Portable has a list price of $2995.00 in the U.S. The list price of the ThinkJet printer is said to be $495.00. The HP-9114A disk drive has a reported price of $795.00. Contact your local HP personal-computer dealer or phone toll-free 800-FOR-HPPC in the U.S. for more information.

REVIEW OF ROM SOFTWARE MODULES

This is a continuation of the reviews and commentaries on the Sharp software modules that originated in Issue 33 of *PCN*. The views are those of *Robert Sutliff, 55 North Avenue, New Rochelle, NY 10805*, and do not necessarily reflect the opinions of *PCN* or its editorial staff.

General Statistics (CE-502A)

This library offers a wide variety of programs in statistics and is primarily intended for the user who needs to analyze raw data. Norlin Rober gave a review of this module in Issue 26 of *PCN*. Given paired or unpaired data these programs compute many of the statistics which, with the aid of standard tables, allow decisions in hypothesis testing to be made. Statistical tables (or the Statistical Distributions module) are a must when using this library. Unfortunately, only numerical input is allowed so that arithmetic, function or coded values cannot be input (except in the ANOVA programs). The programs include:

1. Means and Moments. These statistics can be used to compute standard deviation, skewness and kurtosis. As Mr. Rober pointed out, there are often compounded rounding errors. This can be reduced by coding the data.
2. t-Test: Unpaired.
3. t-Test: Paired. Note that there is a typo on page 61 of the manual which should read: "If the statistic calculated falls *outside* this region of acceptance...", etc. Also, the correct region in this problem should be (-2.262, 2.262).
4. Analysis of Variance: One-Way.
5. Analysis of Variance: Two-Way.
6. Contingency Table. Just over 200 elements can be entered in one run.
7. Mann-Whitney Rank Sum Test. This test is comparable to the Wilcoxon test, although the formulas are slightly altered. As Mr. Rober noted, a Shell sort subroutine labeled RS1 is contained within this program and can be used by a user program residing in RAM.

A routine for computing normal distribution values from values of z exists in lines 28205 to 28340. This routine may also be utilized by a user program residing in RAM. Additionally, the first five programs allow unlimited amounts of data to be entered in a single run by using data bases. Data is entered in blocks which fill the memory. Each block may then be edited, summed, recorded and finally discarded to make room for the next block. Use of a printer is optional. If the optional printer/cassette unit is not attached, then prompts for its use will not appear.

The manual has many good points to recommend it. It offers essays on the applications of each program that both the novice and expert will appreciate. There are extensive comments on variable use, subroutines, cassette files, statistical formulas, and suggested reading. The General Statistics library will appeal to users who are knowledgeable in the subject matter and who can work from samples.

Statistical Distribution (CE-502B)

This library is intended as a companion to the General Statistics Module (CE-502A) just described. The values generated by the previous module can be compared to standard test values and evaluated by this module. This library contains the most commonly used lookup tables as well as interesting histogram and regression programs. The module includes the following:

1. Histogram. This program classifies raw or grouped data into up to 243 cells of any specified width. Data bases are used to allow unlimited amounts of data to be entered. Data can be loaded from or saved to cassette files. This program does not actually draw the histogram, but outputs the cells with frequencies, means, and moments. Once these statistics have been computed the user has the option of comparing the histogram to any of these classical theoretical distributions: binomial, normal, Poisson, Weibull or uniform. One can input parameter values to be used in the theoretical comparison or default to values calculated from the input data. The expected frequencies of the theoretical distribution which are output can be compared to the observed frequencies, and a chi-square statistic can be used to test goodness of fit. If the null hypothesis is that the input data come from a population having the selected theoretical distribution, then an output chi-square area gives the probability that this hypothesis is correct. The higher this value, the better the indication that the data does indeed fit the theoretical distribution. There is a programming error which fails to reinitialize certain values whenever the error indicator "EXP.FREQ.=0" occurs. Though the program seems to go to a recovery point after this, make sure to break the program and reenter the data in order to assure correct results. There are also several instances where a "recovery from error" leaves the user at a different point than where the error was

encountered. Annoyingly the program must be redone from start. Finally, depending on the selected theoretical distribution, there is sometimes considerable rounding error in the chi-square values.

2. Binomial Distribution. Given a number of trials and the probability of success in each trial, this program computes the probability of any exact (or fewer) number of successes.

3. Poisson Distribution. Given the average number of successes in the run, this program offers the same probability as the binomial distribution.

4. Normal Distribution. This program relieves the tedium of using the standard z table. One can input z-value and obtain left- and right-tail probabilities. Alternately, one can input a right-tail probability and obtain the corresponding z-value.

5. Weibull Distribution. Upon input of the shape and scale parameters, one can enter a point and obtain the right-tail probability or vice versa.

6. Exponential Distribution. The previous program is used to compute this variation of the Weibull distribution.

7. Chi-Square Distribution. In measuring variance, the degrees of freedom and chi-square value are input and the right-tail area is output.

8. Student t Distribution. The degrees of freedom and test statistics determine the left-tail probability, not the two-tail probability as the manual states.

9. F Distribution. Given the two degrees of freedom and the F statistic, the right-tail probability is computed.

In programs (7) to (9), it is the inverse procedure that is needed in most applications, namely, inputting a probability value and obtaining a test statistic. There is no provision for this operation. However, inverse algorithms are not very accurate and sometimes are not available. It is easy to get used to using the programs as they exist in order to get results. The user who is determined to use the inverse procedure can easily add a RAM program to approximate inverse values using the programs in this library.

10. Multiple Linear Regression. If a variable is thought to be a linear combination of several independent variables, then this program will approximate the coefficients in the functional expression. The user enters observed data points and the program computes the linear expression as well as correlation coefficients and other associated statistics. There must be more data points than the number of independent variables. This program can be used for a single linear regression by using only one independent variable. This program uses a routine called INV to compute the inverse of a matrix. This routine may be used by a program in RAM. However, in computing the inverse of the correlation coefficient matrix, the same algorithm at that in the Math Library Matrices programs is used. This procedure contains an error and so the same kind of problem may occur here. An "INSOL.MATRIX" prompt may appear even when a solution does exist. Switching the order of entry of data points may help.

In all of the mentioned programs of this library, function and arithmetic values can be directly entered as input. The printer is optional and printer/cassette related prompts will not appear if it is not attached. The good quality of the manual repeats from the General Statistics Library manual. The programs are straightforward to use, but the user will have to bear in mind the errors in the Histogram and Multiple Linear Regression programs. Although not technically a glitch, one other thing is annoying. Titles for each distribution are set up so that each program can announce itself when chosen, but they are utilized only when the printer is attached!

Finance Module (CE-504A)

This module contains a wide (and relatively unassociated) collection of programs meant to aid in financial decision making. The programs will appeal to many different users, although any particular person might find only one or two of the programs of interest. There are annuity, days-between-dates, and cash flow analysis programs for bankers, bond analysis for investment analysts, a rent-buy program for real estate investors, and machine replacement and depreciation programs for business managers. In all these programs, only a limited number of key quantitative factors can be taken into account. The output should only be considered an aid, and not authority, in decision making. As the adage goes, there is no substitute for experience. The seven programs are:

1. Annuity/Annuities Due. This extremely versatile program handles the five variables used in ordinary annuity computations: the principle value PV, future value FV, interest I, number of payment periods N, and payment per period PMT. Upon input of four variable values, the unknown fifth is computed. An option allows payments to be computed at the beginning or end of the

compounding period. This handy program is built into business calculators, such as the TI Business Analyst. The PC-1500/A goes one step further by printing out an amortization schedule on the plotter! For example, consider a $6,000 car loan made by a firm offering 10% (annual interest) financing. If the loan is to be repaid in semi- annual installments over a period of three years, the computer calculates an installment payment of $1,182.10 per half year. The installment schedule is printed and the total interest of $1,092.62 can be added to the loan to find the total repayment amount. This program can be used for mortgages, loans, savings accounts, investments, etc. Compound interest problems are handled by letting PMT equal zero. All variables can be printed by pressing P. The payment schedule can be printed for any interval of periods specified by the user. One item not mentioned in the manual: you must press E to exit the program.

2. Depreciation. This program gives the figures for a depreciation table on an item over a period of time, based on its book value, salvage value and expected useful life. The user can select the straight line, declining or sum-of-years method of depreciation, making this program great for tax purposes. If the declining method is chosen, the user can elect to use a crossover to the straight line method so that the depreciation will be optimized. The crossover is calculated and done automatically! A few other inputs yield the output which consists of four (unexplained by the manual) quantities each year: ACU.D = the accumulated depreciation to date, DEP = depreciation this year, RBV = revised book value (of item at this date) and RDV = revised depreciation value (= RBV - salvage value). A six year depreciation table using the declining method with crossover is shown for illustrative purposes. The example assumes an item with a book value of $10,000, salvage value of $1,000, a 5-year life and declining balance rate of 120%, with the purchase occurring in June.

3. Machinery Replacement Analysis. Enter the useful life, interest rate, price, salvage value and operating costs of a new machine as well as the same data for a machine already in use, and the program compares the expenditures on each for the remaining life of the existing machine and declares which option is better, i.e., whether or not to replace the existing machine. This program actually states the decision for you, but the user should simply take this as advice. Any item that wears out can be considered as a "machine" in this program.

4. Days-Between-Dates. Used by bankers (and computer show-offs), this program will accept any date and output the day of the week on which the date falls. Alternately, it will accept any two dates and output the number of days between the dates. Certain restrictions exist on allowable dates due to calendar changes made throughout history. The user can select 360- or 365-day years (366 on leap year).

5. Rent/Buy Decision. Consider the decision of buying a house or renting a dwelling. Thirteen inputs are made about the house and rent alternative. Ten output values give the yield (rate of return) gain or loss over the rent alternative as well as the break-even values of each alternative over the other.

6. Bond Analysis. The user inputs data on a bond, such as purchase and redemption dates, compounding period, type of bond, interest rate, call price and accounting period. Based on a $100 bond, the program then computes the percent yield when given the purchase price or vice versa. The user even has the option of asking that these computations be made before or after the tax yield. When this choice is taken, then the user must enter personal income and capital gains tax brackets! This handy program quickly computes the purchase price necessary to give a $100 bond value at a given percent yield. This can be used to classify types of bonds according to yield value. The inverse process provided by the program is more useful. The yield is computed based on a purchase price for a $100 bond. If the purchase price exceeds $100, then the bond is being bought "at a premium". There is a typo in example 2 in the program's manual (the yield is being computed, not the purchase price).

7. Cash Flow Analysis. This program outputs the net present value (NPV) or financial management rate of return (FMRR) for a grouped, variable or graduated cash flow analysis. Up to 100 cash flows can be input for a single analysis. The inputs vary with the type of analysis. The NPV or FMRR can be used to judge the profitability of a project based on an initial investment. The FMRR is used when one needs to take into account cash flows generated by the investment, reinvestment amounts, and short- as well as long-term investment rates.

In all of these financial programs, arithmetic and function expressions can be used for input. Output is always rounded to two decimal places. Sometimes more decimal places are needed (for

example when dealing with interest rates) and can be obtained by recalling the variable values from locations A to Z. Although no documentation is given for any program except Bond Analysis, it is easy to find where the variables are stored by recalling A to Z. Use of the printer is optional in all programs. Due to an oversight, whenever the printer is selected it is left in the GRAPH mode. The manual provides good examples and summaries, though it could use more explanations on the use of the output in decision-making. The programs overlap in different fields of financial management. In all, the Finance Library offers an interesting potpourri of financial applications.

SharpCalc Module (CE-507A)

A spreadsheet for your pocket computer? Here it is! Although SharpCalc can't match the speed or versatility of a Multiplan, it certainly shows off the capabilities of the PC-1500/A and its printer. Many people choose a pocket computer for their first experience with a micro, so SharpCalc can act as an introduction to spreadsheet analysis. For people who use their pocket computer extensively in the field, Sharpcalc can be an impressive tool for on-the-spot analysis. (Even though any spreadsheet takes time to set up, the great advantage of CMOS memory is that the spreadsheet is not lost when the computer is turned off!) The entire program is loaded by a quick module installation. The printer is optional since any cell (and even a mock-up of a row) can be displayed on the LCD screen. However, use of the printer enables one to elaborately print out the entire spreadsheet, complete with titles.

The program is not available for listing in the PRO mode or by use of the arrow keys. The main body, however, is written in BASIC. When the module is installed and the computer is in Reserve Group II, the six softkeys become direction keys for moving throughout the spread- sheet. Fifteen remaining keys, when used with DEF, activate program sections. A plastic template is provided to fit over the keyboard and show the operation of each defined key. User RAM is used up quickly by this program so do not plan on any resident RAM programs. Unlike other modules, there are no flashing default values provided for inputs. Thus, every question put forth by SharpCalc needs a typed response. The program contains extensive prompts, cues and responses in a very friendly manner. SharpCalc, through its well written manual, is a snap to learn!

A spreadsheet consists of a table with rows and columns, each location of which is called a cell. SharpCalc allows up to 225 cells to be set up with a maximum of 26 rows (labeled 1 to 26) and 26 columns (labeled A to Z). For example, the cell in the fith row and sixth column would be denoted as 05F. The home location is 01A. If many relations are defined (see below) the size of the spreadsheet might have to be reduced.

The first task that must be done in order to use the program is to "set up" a spreadsheet. Once set up (sized) it cannot be altered by adding or deleting rows or columns. The display "windows in" on one cell at a time. The user moves the window using the GO UP, GO DOWN, GO LEFT and GO RIGHT keys. GO HOME sets the window to 01A, while GO LOC may be used to jump to any specified cell. WINDOW shows an entire row of the spreadsheet (in groups of 7 cells) using clever LCD graphics to display the row number and indicate the contents of each cell using abbreviations. This display also denotes which cell the window FOCUS command is on.

The next step is to use the FILL IN mode to define the contents of each cell. A cell may contain a numeric value, a string up to four characters in length, or an arithmetic or functional expression involving other cells, called a relation. The latter concept is what makes electronic spreadsheets so popular.

SharpCalc allows the following relations:

1. The operations +, -, *, / and ^ (exponential) on two cells.

2. Operations involving a constant. A constant must be assigned a value. That value may be used repeatedly throughout a spreadsheet.

3. Functions on a single cell, such as SIN, COS, TAN, LOG, LN, INT, ABS, EXP, CHS, FRA, PCT(%), %CH, COPY, SQR and CUB (cube). For example, cell 07B could contain @FRA02C which would direct that the program find the decimal fractional part of the numeric value in cell 02C.

4. Row/column operations or functions on multiple elements. The following kinds of operations may be performed on any consecutive elements in a row or column: +, -, *, /, ^, AVG, ANB, MAX, or MIN. For example, cell 04B could contain 02A@ANB10A meaning find the average of the non-zero numbers in the column elements 02A through 10A.

Once the cells in a spreadsheet have been filled in, the user may verify the contents using the VIEW IN mode or the PRT INPUT mode, if a hardcopy is desired. All parameters such as the number of rows,

columns, relations, etc., may be checked using the VIEW CONFIG or PRT CONFIG directives.

The spreadsheet may be evaluated by either row or column precedence, using the COMPUTE command. The computed values may be viewed on the display in the VIEWOUT mode. Alternately the entire spreadsheet may be printed via the PRT OUTPUT instruction. Additionally, titles of up to 4 characters may be filled in for each row and column. Any errors may be located by the LOC CHECK operation. Any section may be ended using EXIT.

The spreadsheet may be stored on cassette tape using SHT TFR to activate sheet transfer. Likewise, a stored sheet may be loaded into the computer. When the printer is used, the entire spreadsheet is printed along with an inputted title. Either the inputted data or computed cells can be printed. Any or all rows may be accented with a line feed, underline (solid or dashed) and color. Negative amounts may be specified to be output in red. A two decimal place business format may be selected. Finally, the entire spreadsheet may be printed in any of three sizes! (The sheet is printed vertically in sections.)

Some of the best spreadsheet abilities are provided by SharpCalc. The LCD is effectively utilized to permit studying of the spreadsheet with abbreviations on the side of the display always showing which mode the user is in. If you own a PC-1500/A and would like to experience spreadsheet techniques, SharpCalc is a simple way to do so.

Example *Outputs from the Finance Module (CE-504A).*

```
        AMORTIZATION SCHEDULES

PRINCIPAL              -6000.00
INTEREST RATE              5.00
PERIODS                    6.00
REGULAR PAYMENT         1182.10

 NO.    AMORTIZED      INTEREST       BALANCE
   1       882.10        300.00        5117.90
   2       926.21        255.89        4191.69
   3       972.53        209.58        3219.16
   4      1021.14        160.96        2198.02
   5      1072.21        109.90        1125.81
   6      1125.81         56.29           0.00

ACCUM INT. FROM 1 TO 6 IS      1092.62
ACCUM AMO. FROM 1 TO 6 IS      6000.00
```

```
YEAR:  1
DEP          1200.00
ACU.D        1200.00
RDV          7800.00
RBV          8800.00

YEAR:  2
DEP          2112.00
ACU.D        3312.00
RDV          5688.00
RBV          6688.00

YEAR:  3
DEP          1625.14
ACU.D        4937.14
RDV          4062.86
RBV          5062.86

YEAR:  4
DEP          1625.14
ACU.D        6562.29
RDV          2437.71
RBV          3437.71

YEAR:  5
DEP          1625.14
ACU.D        8187.43
RDV           812.57
RBV          1812.57

YEAR:  6
DEP           812.57
ACU.D        9000.00
RDV             0.00
RBV          1000.00

CROSSOVER:3
```

IMPROVED VERTICAL LISTER PROGRAM

Here is an improved version of the Vertical Lister previously described in Issue 27 of *PCN*. This one is written entirely in machine language.

It can be left residing in memory and used at any time without the need for MERGEing a BASIC portion. It will print token words used by programs utilizing the CE-158 (provided that the CE-158 is connected).

Listings may be made in either CSIZE 1 or CSIZE 2. In size 2, each "page" printed will contain 12 lines of up to 42 characters-per-line. In size 1, 24 lines having up to 84 characters each may be printed. Long lines will wrap-around to the following line.

If memory contains MERGEd programs, they will all be listed.

Entering the Program

The listing supplied with this article places the Vertical Lister program in the Reserve memory area of a computer having the CE-155 8K memory module installed. However, this program is completely relocatable. You can put it wherever you want it. If you have a PC-1500A, it is suggested that you put it into memory starting at the address &7D00. If you have a 16K RAM module and do not want to lose the Reserve area, you may wish to reallocate the computer's memory by executing NEW &01A0 and then putting the program into the area beginning at &0D00. If you do not have a Monitor program, you will have to enter the program using POKE statements.

When the program has been loaded into memory, it may be saved on tape by execution of the command string CSAVE M "VERTICAL LISTER";&3800,&38C4. (Naturally, if you locate your copy of the program elsewhere, you will have to change the starting and ending addresses used in your CSAVE M statement accordingly.) The program may be reloaded from tape using the CLOAD M command into the same addresses from which it was originally CSAVEd. Alternately, load it into some other location by specifying the starting address in the CLOAD M command.

Using the New Vertical Lister Program

To produce a vertical listing, simply execute CALL &3800 (or whatever address you have used as the beginning address of the machine language program). If you interrupt the vertical listing process with BREAK, execute TEXT following the break in order to reset the printer.

The program is not totally idiot-proof. If you execute it when there is no BASIC program in memory, the result may be having some garbage printed!

This program provided by: *Norlin Rober, 407 North 1st Avenue, Marshalltown, IA 50158.*

Program *Improved Vertical Lister.*

```
3864 B7 3A ED 79   3800 E9 78 50 00
3868 F4 01 8B 02   3804 EB 79 F0 FF
386C B7 63 83 24   3808 BE D2 6F BE
3870 44 F5 88 03   380C AC 97 DD AE
3874 FD 0A 84 5E   3810 79 F2 B5 D8
3878 3A ED 79 F4   3814 FB B1 09 ED
387C 01 8B 02 5E   3818 79 F4 01 83
3880 63 83 14 9E   381C 02 B1 09 FD
3884 36 4A 10 14   3820 C8 48 7B 4A
3888 00 2A BE B4   3824 7F 43 B5 00
388C F4 BE D2 B3   3828 43 43 0E BE
3890 83 10 8E 12   382C AC 07 BE A7
3894 FD 0A 46 46   3830 69 5A 10 CC
3898 CA 50 4A 10   3834 50 8B 08 E9
389C 14 00 2A BE   3838 78 50 00 51
38A0 B4 F4 FD 8A   383C 51 8E 10 48
38A4 99 92 FD C8   3840 7B 4A B0 F5
38A8 48 7B 4A 7F   3844 05 B7 3A 83
38AC B5 00 43 43   3848 04 B7 30 33
38B0 B5 C0 43 B5   384C 0A B5 3A 51
38B4 FD 0E BE AC   3850 45 B7 0D 8B
38B8 07 BE A7 69   3854 30 B7 E0 81
38BC FD 8A 9B B5   3858 1E 28 45 2A
38C0 BE AC BB CD   385C FD 88 CD 1C
38C4 42            3860 04 DF 2A 12
```

LINEAR SYSTEMS

This program for the PC-1500/PC-2 will find the solutions of a system of linear equations. The size of the system that it can handle depends on the amount of memory present. When used with the PC-1500A and a CE-161 RAM module, it can solve a system of 50 equations. Using the PC-1500 and an 8K RAM module, a system may contain up to 32 equations.

An Example

This example illustrates how the program may be used. Assume we wish to solve the system of equations:

$$\begin{aligned} 3W + 2X + 6Y + 2Z &= 2 \\ W + 4X + 3Y + 2Z &= 6 \\ 4W + 2X + 5Y + Z &= 1 \\ W + 5X + 3Y + 3Z &= 3 \end{aligned}$$

Execute RUN after loading the program. Respond to the prompt "NO OF EQ?" with 4. The display will show prompts for inputting the coefficients, using A1, A2, etc., with the constant term designated C. Thus, in this example, when asked for "EQ 1: A1?", the first coefficient in the first equation should be inputted, which is 3. Similarly, respond to "EQ 1: A2?" with 2, to the next prompt with 6 and then with 2. When the prompt "EQ 1: C?" appears, the constant term on the right side of the equation (which is 2 here) should be inputted.

After inputting the values, the prompt "EDIT?" will be displayed. If you do not wish to edit or review the inputs you have entered, key ENTER. If editing is desired, input "Y" followed by ENTER. If the latter option is taken, the equation number that you wish to review will be requested. After this information has been given, each coefficient in that equation will be presented for review, followed by a question mark. If you wish to alter the coefficient, enter the new value. Otherwise, just press ENTER.

After editing, the prompt "PRINT?" will be displayed. Respond with a "Y" to print a list of the coefficients or key ENTER to skip printing.

The correct solutions for the equations used in this example are W=-2, X=3, Y=2 and Z=-5. The display should show these as X1, X2, X3 and X4. Due to limitations of floating-point arithmetic, the first solution will be given as -1.999999999 rather than as -2 and the fourth as -4.999999999 rather than -5.

The query "PRINT?" will be shown again, offering the option of printing the calculated results.

Execution Times

A system of five equations will take about 6 seconds. Ten equations: 42 seconds. Twenty equations: 5 minutes and 20 seconds. Thirty equations: just under 18 minutes.

The message "NO SOL" will be displayed when there is no unique solution to the system. This occurs when the system is either inconsistent or dependent.

Norlin Rober, 407 North 1st Avenue, Marshalltown, IA, 50158, submitted this routine.

Program *Linear Systems.*

```
10:INPUT "NO OF E
   Q? ";N:DIM A(N
   ,N+1):GOTO 12
11:GOTO 10
12:WAIT 0:FOR I=1
   TO N:FOR J=1TO
   N
13:CLS :PRINT "EQ
   ";I;": A";STR$
   J;:INPUT "? ";
   A(I,J):NEXT J:
   GOTO 15
14:GOTO 13
15:CLS :PRINT "EQ
   ";I;": C";:
   INPUT "? ";A(I
   ,N+1):NEXT I:
   GOTO 24
16:GOTO 15
20:INPUT "EQ NO?
   ";I:IF I>0AND
   I<=NTHEN 22
21:GOTO 20
22:FOR J=1TO N:
   CLS :PRINT "EQ
   ";I;": A";STR$
   J;"=";A(I,J);:
   INPUT "? ";A(I
   ,J)
23:NEXT J:CLS :
   PRINT "EQ";I;"
   : C=";A(I,N+1)
   ;:INPUT "? ";A
   (I,N+1)
24:CLS :INPUT "ED
   IT? ";A$:GOTO
   20
30:WAIT :INPUT "P
   RINT? ";A$:
   GOTO 32
31:GOTO 40
32:FOR I=1TO N:
   LPRINT "EQUATI
   ON";I:FOR J=1
   TO N:LPRINT
   STR$ J+" ";A(I
   ,J):NEXT J:
   LPRINT "C ";A(
   I,J):LPRINT :
   NEXT I
40:CLS :FOR I=1TO
   N-1:IF A(I,I)<
   >0THEN 50
41:FOR J=I+1TO N:
   IF A(J,I)=0
   NEXT J:PRINT "
   NO SOL":END
42:FOR K=1TO N+1:
   M=A(J,K),A(J,K
   )=A(I,K),A(I,K
   )=M:NEXT K
50:FOR J=I+1TO N:
   FOR K=I+1TO N+
   1:A(J,K)=A(J,K
   )-A(I,K)*A(J,I
   )/A(I,I):NEXT
   K:NEXT J:NEXT
   I
51:IF A(N,N)=0
   PRINT "NO SOL"
   :END
52:M=N+1:FOR I=N
   TO 2STEP -1:
   FOR J=1TO I-1:
   A(J,M)=A(J,M)-
   A(J,I)*A(I,M)/
   A(I,I):NEXT J:
   NEXT I
60:FOR I=1TO N:
   PRINT "X"+STR$
   I+"=";A(I,M)/A
   (I,I):NEXT I
70:INPUT "PRINT?
   ";A$:LPRINT "S
   OLUTION:":FOR
   I=1TO N:LPRINT
   STR$ I+" ";A(I
   ,M)/A(I,I):
   NEXT I:LPRINT

STATUS 1 = 890
```

ISOMETRIC DRAWINGS

Richard H. Chrystie, 14824 E. Walbrook, Hacienda Heights, CA 91745, provides this program that is designed to make isometric drawings. The number of components per drawing is dependent on the amount of memory in your PC as shown in the accompanying table.

Components are rectangular or cylindrical solids. The axis of rotation for the cylinders is either the X, Y or Z axis. A scale factor is inputted by the user. If a scale of 1 is selected, all dimensions are in inches. The color of each item may be specified. After an item is drawn, the program asks if you want another item, thus you may make drawings of single or multiple items.

The program is written in BASIC so it is slow. Drawings are limited in size to the distance that the printer can back up.

After an initial view has been drawn you can alter the scale or viewing angle. A rotation of 30 degrees and a tilt of 10 degrees is nice. A rotation of 0 degrees and a tilt of 0 degrees produces a side view. Rotating to 90 degrees results in an end view.

Program *Isometric Drawings.*

```
  5 "3VIEW2"
 11 CLEAR
 15 TEXT :COLOR 0
 20 C=-1
 50 DIM X(15,26),Y
    (15,26),Z(15,2
    6),C(15)
 70 DIM R(26),T(26
    ),B$(15),G(15)
 72 GOSUB 300
 75 INPUT "SCALE?"
    ,S:S=126.5823*
    S
 80 CSIZE 1
 81 LPRINT "SCALE=
    ",S/126.58:LF
    1
 82 LPRINT "    NO
        UP     RT
        BK"
 83 LF 1
100 INPUT "WANT AN
    OTHER ITEM?",A
    $
101 IF A$="N"THEN
    430
105 INPUT "ITEM NU
    MBER?",N
106 INPUT "COLOR?"
    ,C(N)
110 INPUT "BOX or
    CYLINDER (B/C)
    ?",B$(N)
111 IF B$(N)="C"
    THEN 700
115 INPUT "DIST UP
    ?",W
116 INPUT "DIST RI
    GHT?",U
117 INPUT "DIST BA
    CK?",V:V=-V
120 INPUT "BOX HEI
    GHT?",Z
125 INPUT "BOX WID
    TH?",X
130 INPUT "BOX DEP
    TH?",Y:Y=-Y
133 GOSUB "E"
134 G(N)=16
135 X(N,1)=U:Y(N,1
    )=V:Z(N,1)=W
140 X(N,2)=U+X:Y(N
    ,2)=V:Z(N,2)=W
145 X(N,3)=U+X:Y(N
    ,3)=V+Y:Z(N,3)
    =W
150 X(N,4)=U:Y(N,4
    )=V+Y:Z(N,4)=W
155 X(N,5)=U:Y(N,5
    )=V:Z(N,5)=W
160 X(N,6)=U:Y(N,6
    )=V:Z(N,6)=W+Z
165 X(N,7)=U+X:Y(N
    ,7)=V:Z(N,7)=W
    +Z
170 X(N,8)=U:Y(N,8
    )=V:Z(N,8)=W+Z
175 X(N,9)=U:Y(N,9
    )=V+Y:Z(N,9)=W
    +Z
180 X(N,10)=U:Y(N,
    10)=V+Y:Z(N,10
    )=W
185 X(N,11)=U:Y(N,
    11)=V+Y:Z(N,11
    )=W+Z
190 X(N,12)=U+X:Y(
    N,12)=V+Y:Z(N,
    12)=W+Z
195 X(N,13)=U+X:Y(
    N,13)=V+Y:Z(N,
    13)=W
200 X(N,14)=U+X:Y(
    N,14)=V+Y:Z(N,
    14)=W+Z
205 X(N,15)=U+X:Y(
    N,15)=V:Z(N,15
    )=W+Z
210 X(N,16)=U+X:Y(
    N,16)=V:Z(N,16
    )=W
220 GOTO 100
250 INPUT "TAPE RE
    ADY?",B$
252 IF B$="Y" THEN
    256
254 GOTO 250
256 RETURN
300 INPUT "LOAD FR
    OM TAPE?",B$
305 IF B$="Y"THEN
    315
310 RETURN
315 INPUT "WHAT TI
    TLE?",I$
320 GOSUB 250
330 INPUT #I$;X(*)
    ,Y(*),Z(*),N,S
    ,C(*),G(*),B$(
    *)
335 RETURN
350 INPUT "SAVE ON
    TAPE",B$
355 IF B$="Y"THEN
    365
360 RETURN
365 INPUT "WHAT TI
    TLE?",I$
370 GOSUB 250
375 PRINT #I$;X(*)
    ,Y(*),Z(*),N,S
    ,C(*),G(*),B$(
    *)
380 RETURN
430 GRAPH
450 GLCURSOR (30,-
    250):SORGN
455 T=25:F=35.26
460 FOR M=1TO N
465 GOSUB "DRAW"
470 NEXT M
475 GLCURSOR (0, -3
    00)
480 INPUT "NEED AN
    OTHER STRIP?",
    D$
485 IF D$="N"THEN
    491
486 GLCURSOR (-215
    ,-500):SORGN
488 K=K+215
490 GOTO 460
491 INPUT "WANT TO
    REVISE DATA?"
    ,A$
492 IF A$="N"THEN
    500
493 GOTO 100
500 INPUT "WANT AN
    OTHER VIEW?",A
    $
510 IF A$="N"THEN
```

Tilting to 90 digrees gives a top view. Large drawings are produced by pasting together strips side-by-side.

Drawings may also be stored on tape for long term storage.

Caution: Be sure to change the DIMension statements in lines 50 and 70 in accordance with the accompanying table! Failure to properly size the arrays to match the memory available in your system can result in improper operation and loss of data.

Table *Memory Requirements.*

Items	RAM Req'd	Equipment	Data Storage
5	7.3K	8K Module	About 90 in.
10	10.7K		
15	14.1K	16K Module	About 270 in.
20	17.5K	16K Module	About 360 in.
25	20.1K	26K System	

```
    990
511 INPUT "WANT AN
    OTHER SCALE?",
    C$
512 IF C$="N"THEN
    520
514 INPUT "SCALE?"
    ,S:S=126.5823*
    S
520 INPUT "HORIZ.
    ROTATION?",T
530 INPUT "VERTICA
    L TILT?",F
536 GLCURSOR (K,-2
    00):SORGN
537 K=0
540 GOTO 460
700 INPUT "DIST UP
    ?",W
701 INPUT "DIST RI
    GHT?",U
702 INPUT "DIST BA
    CK?",V
703 INPUT "RADIUS?
    ",F
704 INPUT "HEIGHT?
    ",H
705 G(N)=26
706 TEXT :CSIZE 1:
    USING "###.###
    ":LPRINT N;W;U
    ;V
707 TAB 7:LPRINT "
    R= ";F;"  H= "
    ;H:LF 1
708 INPUT "MAJOR A
    XIS (X,Y,Z)?",
    B$
709 IF B$="X"THEN
    730
710 IF B$="Z"THEN
    750
714 FOR A=15TO 375
    STEP 30
715 K=1+A/30
716 X(N,K)=U+F*SIN
    A:Y(N,K)=-V-F*
    COS A:Z(N,K)=W
717 NEXT A
718 FOR K=14 TO 26
719 X(N,K)=X(N,K-1
    3):Y(N,K)=Y(N,
    K-13):Z(N,K)=H
    +W
720 NEXT K
721 GOTO 100
730 FOR A=15TO 375
    STEP 30
731 K=1+A/30
732 Z(N,K)=W+F*COS
    A:Y(N,K)=-V-F*
    SIN A:X(N,K)=U
733 NEXT A
734 FOR K=14TO 26
735 Z(N,K)=Z(N,K-1
    3):Y(N,K)=Y(N,
    K-13):X(N,K)=H
    +U
736 NEXT K
737 GOTO 100
750 FOR A=15TO 375
    STEP 30
751 K=1+A/30
752 X(N,K)=U+F*COS
    A:Z(N,K)=W+F*
    SIN A:Y(N,K)=V
753 NEXT A
754 FOR K=14TO 26
755 X(N,K)=X(N,K-1
    3):Z(N,K)=Z(N,
    K-13):Y(N,K)=V
    -H
756 NEXT K
757 GOTO 100
760 FOR K=1TO 13
761 LINE (R(K),T(K
    ))-(R(K+13),T(
    K+13))
762 NEXT K
763 RETURN
800 "DRAW"
810 FOR I=1TO G(M)
820 R(I)=X(M,I)*
    COS T-Y(M,I)*
    SIN T
830 T(I)=-X(M,I)*
    SIN T*SIN F-Y(
    M,I)*COS T*SIN
    F+Z(M,I)*COS F
840 R(I)=R(I)*S:T(
    I)=T(I)*S
842 NEXT I
844 C=C+1
845 IF C>3THEN LET
    C=0
847 GLCURSOR (R(1)
    ,T(1))
848 FOR I=2TO G(M)
850 LINE (R(I-1),T
    (I-1))-(R(I),T
    (I)),0,C(M)
860 NEXT I
865 IF B$(M)="C"
    THEN GOSUB 760
870 GLCURSOR (0,0)
880 RETURN
940 "E":TEXT :
    CSIZE 1
952 USING "###.###
    ":LPRINT N;W;U
    ;V
953 TAB 7:LPRINT Z
    ;X;Y
954 LF 1
955 RETURN
990 GOSUB 350
995 PAUSE "BY-BY!"
999 END
STATUS 1      2961
```

INSIDE THE PC-1500

This is the fourth part of the current series on the Sharp PC-1500. (Most of this information is also applicable to the Radio Shack PC-2.) This valuable data is supplied through the dedicated efforts of *Norlin Rober, 407 North 1st Avenue, Marshalltown, IA 50158.* This issue picks up from where we left off in Issue 33 of *PCN.* That is, with a continuation of a brief summary of a number of the routines contained in the ROM of the PC-1500. Specifically, Norlin was discussing the subroutine at address &D2EA that is capable of searching for a BASIC program line

A data byte must follow the instruction calling this subroutine. If the line sought is not found, this data byte is added to the return address, with UH containing 0B.

As an alternative, a search for a specified line number (but not for a label) may be begun at the address pointed to by START OF EDIT. This is done by subroutine D2E0, which is identical in all other respects to the above subroutine.

KEYBOARD

POLL OF KEYBOARD

Subroutine E42C loads A with the code for the key (other than BREAK) that is currently depressed. If no key is depressed, A will be loaded with zero. Register Y is unchanged by the subroutine.

The codes determined by the keys are as follows:

01 SHIFT	0F OFF	19 RCL	2D -	35 5	43 C	4B K	53 S
02 SML	11 F1	1B DEF	2E .	36 6	44 D	4C L	54 T
08 left	12 F2	1F MODE	2F /	37 7	45 E	4D M	55 U
09 template	13 F3	20 SPACE	30 0	38 8	46 F	4E N	56 V
0A down	14 F4	28 (	31 1	39 9	47 G	4F O	57 W
0B up	15 F5	29)	32 2	3D =	48 H	50 P	58 X
0C right	16 F6	2A *	33 3	41 A	49 I	51 Q	59 Y
0D ENTER	18 CL	2B +	34 4	42 B	4A J	52 R	5A Z

WAIT FOR INPUT FROM KEYBOARD

Subroutine E243 polls the keyboard until a key code is obtained. Except for the SHIFT, SML, and DEF keys (which act as prefixes), the use of a key produces a return, with a character code in A. The 7-minute powerdown timer operates during the wait. Register Y is unchanged.

The codes obtained for display characters are their ASCII codes.

The codes for control and editing keys requiring the SHIFT prefix are as follows:

1A CA 1C INS 1D DEL 1E SHIFT/MODE

The codes for alphabet keys prefixed by DEF are their ASCII codes plus 40. The other keys accepting the DEF prefix use these codes:

80 DEF SPACE 9D DEF =

The code for BREAK is 0E. If BREAK has been keyed, subroutine E243 will continue to return with this code in A each time it is called, until bit 1 of address F00B in the I/O Port is cleared.

DETECTION OF BREAK KEY

Call A6 (E451) will clear flag Z if BREAK has been keyed. There is no effect on the CPU registers or on other flags.

If BREAK has been keyed, this subroutine will continue to return with flag Z cleared each time it is called, until bit 1 of address F00B in the I/O Port is cleared.

DISPLAY

CURSOR POINTER

The contents of the Cursor Pointer (7875) specify a column of dots in the LCD display; columns are numbered from 00-9B (0-155 decimal).

TO CLEAR DISPLAY

Call F2 (EE71) clears the display. Registers X and Y are unchanged.

TO DISPLAY DATA IN R0 (OR STRING POINTED TO BY R0)

Subroutine E8CA may be used to display numeric data contained in R0 (given in decimal or binary), or a string pointed to by R0. Display will be in default format. Strings are displayed left-justified, and numeric data right-justified. Precede by storing 20 as the value of the Display Parameter (7880).

TO DISPLAY NUMERIC CONTENTS OF R0, FORMATTED

The display will be formed beginning at the location Pointed to by the Cursor Pointer (7875). Contents of R0 must be in decimal.

(1) Store format specifications as follows:

7895: Editing characters. 10, comma separation; 20, forced sign; 40, asterisk fill; 80, scientific format

7896: Number of characters preceding decimal point, including spaces for sign (and commas, when specified).
7898: Number of characters including and following decimal point

(2) Load A with 00, 01, or 02, to specify the position of the characters to displayed, according to the following:

A=00: data displayed right-justified in 13-character block
A=01: data displayed left-justified in block of whatever size is required (up to a maximum of 16 characters)
A=02: data displayed right-justified in 26-character block

Then execute Call 96 (EA78), to form a string of characters (in the area 7A10-7A34) to represent the data to be displayed.

(3) Execute the instruction STX U; then execute Call 92 (ED00).

The cursor pointer will be updated to point to the next available display position. Flag C will be set if the display has been filled.

TO DISPLAY A STRING POINTED TO BY R0

Execute Call DC (DEBC), followed by Call 92 (ED00). The cursor pointer will be updated to point to the next available display position. Flag C will be set if the display has been filled.

TO DISPLAY CONTENTS OF OUTPUT BUFFER

Subroutine ECFA displays the contents of the output buffer starting at 7B60, ending when the display is filled. Characters are entered into the display beginning at the position specified by the Cursor Pointer.

TO DISPLAY A SEQUENCE OF CHARACTERS

Subroutine ED3B will display a sequence of characters whose codes are located anywhere in memory. Precede by loading U with the beginning address of the stored codes, and XL with the number of codes. The characters will be entered into the display beginning at its left end.

TO DISPLAY A PROGRAM LINE

The line to be displayed must be put into the input buffer, starting with its two-byte line number, omitting the link byte, and continuing with the codes for the BASIC statements in the line. A line may be placed into the input buffer in that form in any of the following ways:

(a) Subroutine D26F may be used to place the first BASIC line into the input buffer; the SEARCH pointer will be set to point to that line.
(b) Subroutine D2EA may be used to locate the line whose number has been loaded into U. (A data byte, which will be added to the return address if the specified line does not exist, must follow the instruction calling this subroutine.) After execution of subroutine D2EA, load XH and XL with the contents of 78A6 and 78A7; decrement X twice; and execute subroutine D2D0. The specified line will be in the input

Buffer, and the SEARCH Pointer will Point to that line.
(c) The Pro9ram line that follows the one currentl9 Pointed to b9 SEARCH ma9 be Placed into the InPut Buffer, with automatic uPdatin9 of the SEARCH Pointer, b9 execution of subroutine D2B3.

After the BASIC line has been Placed into the InPut Buffer, it is disPla9ed b9 execution of subroutine E8CA, Provided that an aPProPriate value has been stored as the DisPla9 Parameter (7880). With 10 as that valÙe, the line is disPla9ed from its start, without a colon followin9 the line number in the disPla9; with 14, the colon will be included.

The cursor will be included in the disPla9 if the DisPla9 Parameter contains 50 (no colon) or 54 (colon included). Re9ister Y must be loaded with the address (in the InPut Buffer) at which the cursor is to aPPear.

TO DISPLAY CONTENTS OF INPUT BUFFER, WITH TOKENS EXPANDED

Subroutine E8CA, with the DisPla9 Parameter (7880) containin9 zero, disPla9s the contents of the InPut Buffer, startin9 at 7BB0, endin9 when a 0D code is reached. (The InPut Buffer ma9 be filled with 0D codes Precedin9 this, b9 execution of subroutine D02B.)

The cursor will be included in the disPla9 if 40 is used as the DisPla9 Parameter value; Re9ister Y must be loaded with the address (in the InPut Buffer) at which the cursor is to aPPear.

TO DISPLAY A SINGLE CHARACTER

Subroutine ED4D enters the character whose code is in A into the disPla9, at the Position Pointed to b9 the Cursor Pointer (7875). The Cursor Pointer will be incremented b9 6 each time a character is added to the disPla9, Pointin9 to the next character Position. If the ri9ht end of the disPla9 is reached, additional characters wraP around to the left end of the disPla9.

The character whose code is in A ma9 also be Placed into the disPla9 b9 subroutine ED57. In this case, there will be no automatic increment of the Cursor Pointer.

GRAPHIC DISPLAY

Subroutine EDEF disPla9s the dots sPecified b9 the contents of A, in the column Pointed to b9 the Cursor Pointer. The Cursor Pointer is not incremented automaticall9; Call 8E (EDB1) ma9 be used to do so.

The dots disPla9ed are determined b9 the bits contained in A:

01	ToP dot	10	5th
02	2nd	20	6th
04	3rd	40	Bottom
08	4th		

TIMED DELAY

Call AC (E88C) produces a delay, equal in duration to the product of 1/64 second by the contents of Register U. If the BREAK key is pressed during execution of this routine, the timing cycle ends, and there is a return with flag C set. Register Y is not affected.

This subroutine may be used to produce the equivalent of a PAUSE by effecting a temporary delay while information is being displayed.

BEEP

Subroutine E669 is equivalent to BEEP 1. It ignores BEEP ON/OFF.

Subroutine E66F produces a tone with pitch determined by UL, and duration determined by X. BEEP ON/OFF is ignored. The frequency of the tone is approximately 59230/(7.47+UL) cps (calculated in decimal). The duration (number of cycles) is &100 less than the contents of X.

POWERDOWN

Subroutine CD71 is equivalent to OFF.

Subroutine E33F is equivalent to the automatic 7-minute Powerdown.

TERMINATION AT 'READY'

A machine-language program may be terminated by setting the computer to 'Ready' mode, in which it is awaiting further instructions from the keyboard.

TERMINATE WITH DISPLAY

Call 46 (CA8D) sets 'Ready' mode, retaining the display contents.

If subroutine E8CA has been used to produce a display with the cursor contained in it, the cursor left and cursor right keys will be enabled. (In other cases, however, use of the cursor control keys may result in a meaningless display.)

TERMINATE WITH PROMPT MARK

Call 42 (CA58) will place the computer in 'Ready' mode, with the prompt mark displayed.

POCKET COMPUTER NEWSLETTER
P.O. Box 232, Seymour, CT 06483